





Meteorological Conditions Experienced During the Orion Pad Abort Test

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Range Commanders Council, Meteorology Group Annual Meeting
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Satellite Beach, Fl





PA-1 Flight Dynamics Lockheed Martin

Brian Clarke William Pratt





White Sands Missile Range Weather

Scott Startz

Joshua Schroeder

Mickey Rupe

Anna Phelps

James Wilkes

Edward Ellison

Larry Misquez





- Test Objectives
- Terrain Features
- Test Configuration
 - Range Assets
- Weather Brief
 - Forecasts
 - Day of Launch Observations
- Summary





Primary Test Objectives

- Performance of the Launch Abort System (LAS)
- Stability and control characteristics of a crew module in regards to the LAS
- Determine the performance of the abort, jettison and attitude control motors
- Demonstrate abort event sequencing from abort initiation through LAS jettison
- Obtain LAS/crew module interface structural loads and external acoustics data

Secondary Test Objectives

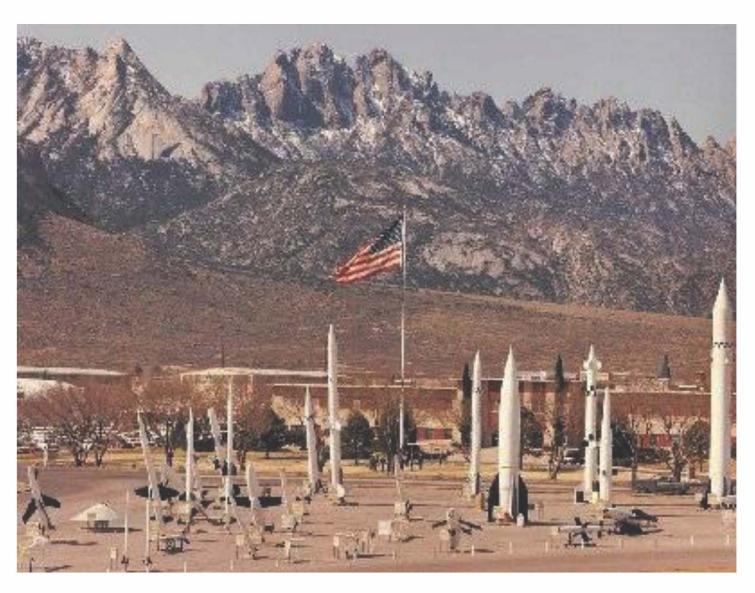
- Parachute assembly system event sequencing
- Performance of the main parachute system.



Natural Terrain - Organ Mountains







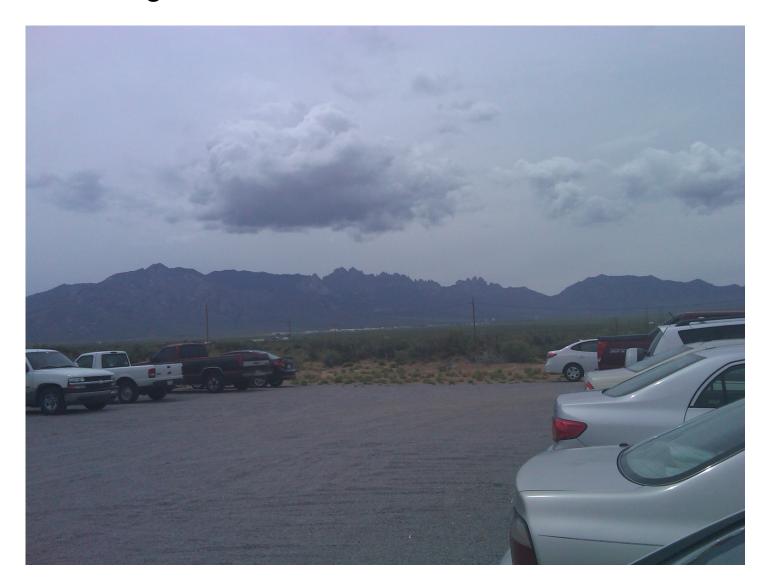


Terrain View from LC-32E





Organ Mountains: View from LC-32E

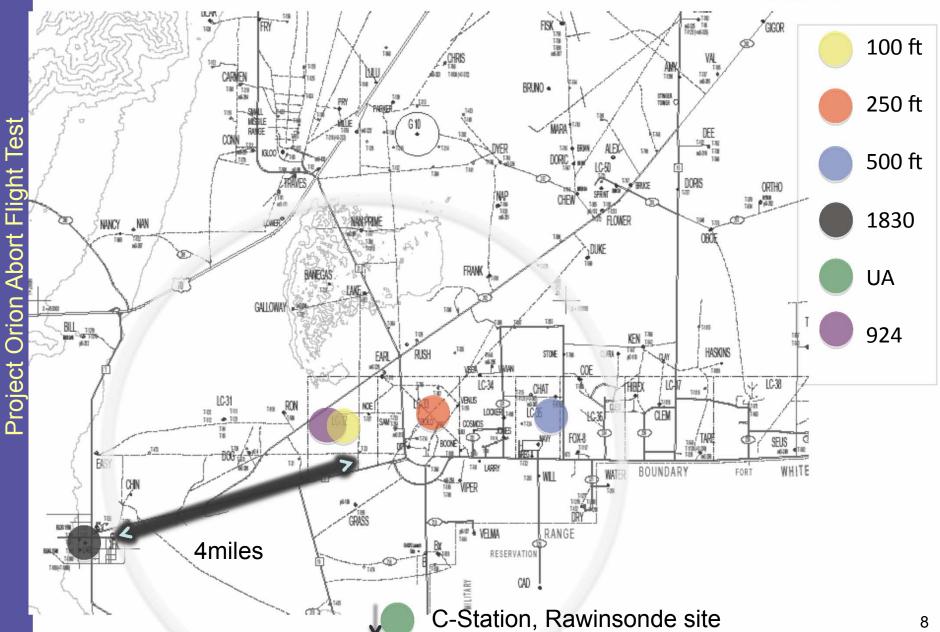




Test Configuration - Range Weather assets











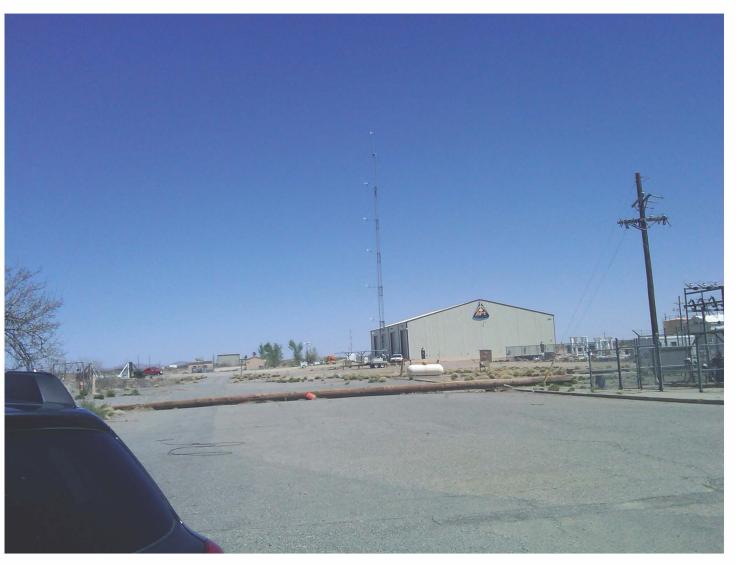






SAMS Wind Tower at LC-32E









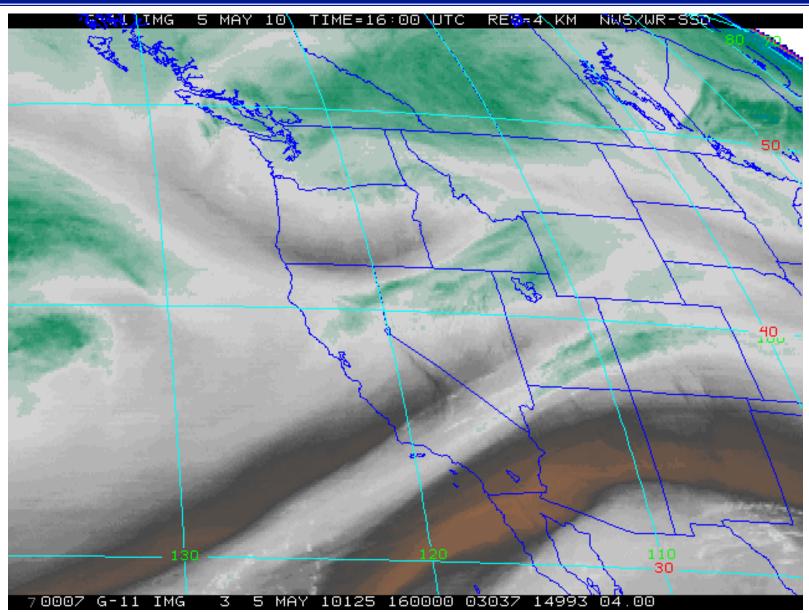
Day of Launch Forecast



WV Satellite Data for Western US

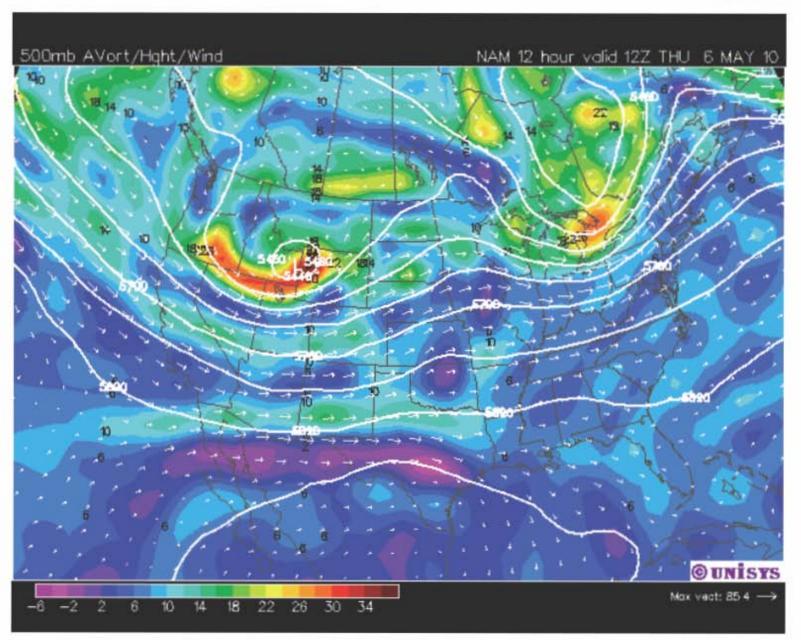






Upper Air Forecast for DOL









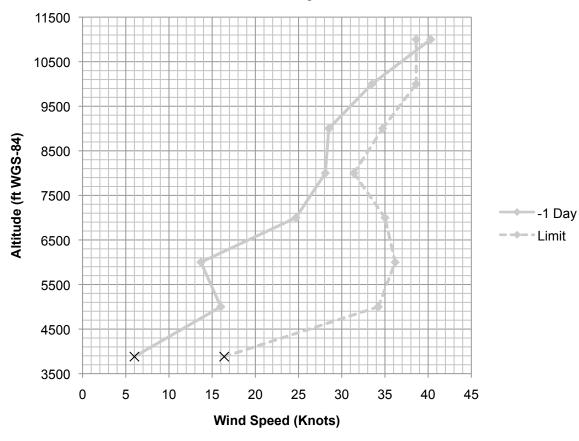


		Time of Forecast (T- time)																	
		T-0 Forecast \	Ninds	Comp	arison						Fligh	t Wind	l Limit	S					
		Balloon & LC Data Entr		Difference (Balloon - Limit)		£ 5	peeds in Knots	Azimuth Clockwise from 0° North (degrees) Meteorological Convention (Azimuth Defines Direction Wind is Blowing From)											
		Azimuth (Meterological degrees)	Wind Speed (knots)	(knots)	(percent)	Wind	.	1-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-36
	Ground Level [†]	190	6	-10.4	-63:4%	e jd	Ground Level ⁺	17.0	19.0	17.4	14.8	11.6	13.3	15.4	24.2	23.9	16.3	13.6	13.3
	5000	267	16	-18.2	-53.3%	Above	5000	20.2	21.6	18.2	17.2	17.8	18.4	25.8	30.5	34.2	20.7	20.0	19.2
- j	6000	257	13.7	-22,5	-62.1%	용별	6000	20.8	23.8	20.5	17.9	18.4	18.5	26.5	33.3	36.2	28.3	21.4	23.3
Ŧ	7000	271	24.7	-10.3	-29,4%	(I)	7000	24.6	26.1	23.1	18.1	17.6	17.1	27.1	35.2	41.6	35.0	24.6	27.7
=	8000	269	28.1	-3,3	-10.5%	nd P8	8000	19.7	17.5	14.8	17.6	17.2	16.8	20.2	28.1	31.4	25.0	19.5	19.8
	9000	263	28.5	-6.2	-17.9%	Altitud NGS-84	9000	22.6	17.9	15.7 17.4	16.5 17.2	16.4 17.6	16.3	20.3	31.7 33.4	34.7 38.6	28.7 32.7	22.0	23.2
	10000	263	33.5	-5.1	-13.3%	₹ ₹	10000	23.2	18.1				18.1	21.7				25.9	26.8
	11000	257	40.3	1.7	4.4%	_	11000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8
		[†] Ground Level refers to LC	.56 ft above WGS	-84. This	line shou	ld be com	pared to	ground lev	vel wind n	neasurem	ents at LC	-32 (6 ft A	GL), not b	alloon da	ta.				
			Violate L Meet Lin	Chicago State Control of the		ole							Keyfor Violate Meet L		nd Limits	Table			





T-0 Forecast Wind Speeds vs Altitude





T-1 Day + 2 hrs Forecast



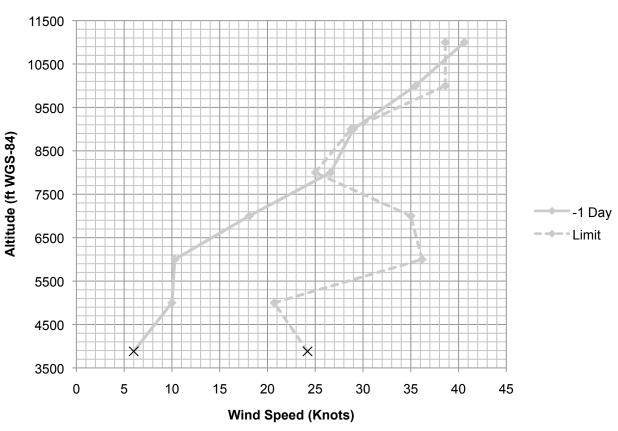
		T+2 Forecast (T-time)	CONTRACTOR OF THE PARTY OF THE	Comr	arison			_			Fligh	t Wind	Limit	S							
		Balloon & LC Data Entr	-32E	Difference (Balloon - Limit)			Wind Speeds in Knots		Azimuth Clockwise from 0° North (degrees) Meteorological Convention (Azimuth Defines Direction Wind is Blowing From)												
loq\		Azimuth (Meterological degrees)	Wind Speed (knots)	(knots)	(percent)	Minds	*	1-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-36		
3	Ground Level [†]	226	6	-18.2	-75.2%	e e	Ground Level†	17.0	19.0	17.4	14.8	11.6	13.3	16.4	24.2	23.9	16.3	13.6	13.3		
5	5000	277	10	-10.7	-51.7%	: Above Ellipsoid	5000	20.2	21.6	18.2	17.2	17.8	18.4	25.8	30.5	34.2	20.7	20.0	19.2		
ti	6000	262	10.3	-25.9	-71.5%	a ii	6000	20.8	23.8	20.5	17.9	18.4	18.5	26.5	33.3	36.2	28.3	21.4	23.3		
-	7000	272	18.1	-16.9	-48.3%	(1)	7000	24.6	26.1	23.1	18.1	17.6	17.1	27.1	35.2	41.6	35.0	24.6	27.7		
ت	8000	278	26.6	1.6	6.4%	nd 84	8000	19.7	17.5	14.8	17.6	17.2	16.8	20.2	28.1	31.4	25.0	19.5	19.8		
	9000	273	29	0,3	0.9%	Altitude WGS-84	9000	22.6	17.9	15.7	16.5	16.4	16.3	20.3	31.7	34.7	28.7	22.0	23.2		
Oject	10000	266	35,5	-3.1	-8.1%	4 5	10000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8		
	11000	258	40.6	2.0	5.1%	_	11000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8		
		⁺ Ground Level refers to LC	Violate Lin	y for Com	parison Tab		.56 ft above WGS	-84. This	line shou	ld be com	pared to p	ground lev		Flight Wi	and the second second		GL), not b	palloon da	ta.		



T-1 Day + 2 hrs Forecast



T+02:00:00 Forecast Wind Speeds vs Altitude





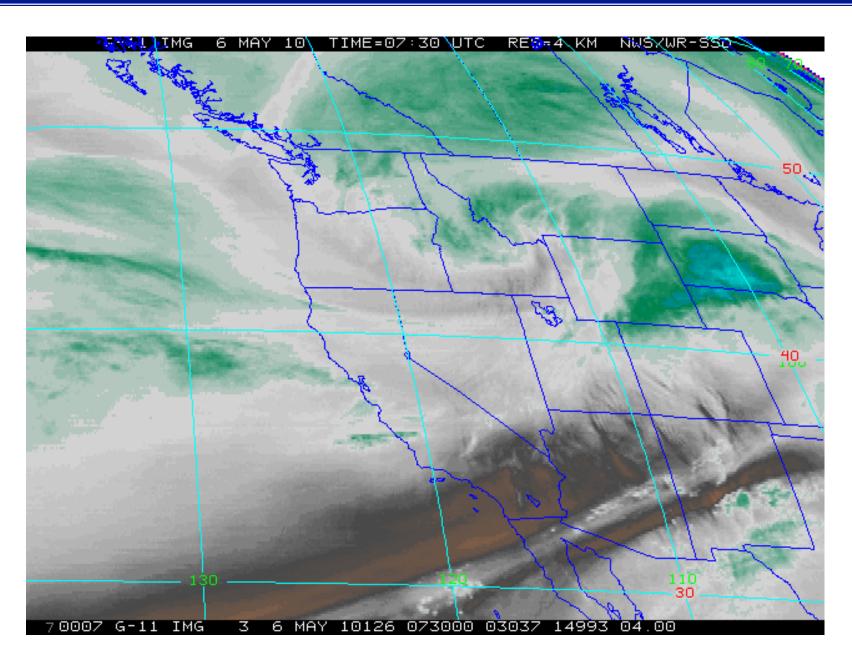


Day of Launch Weather May 6, 2011



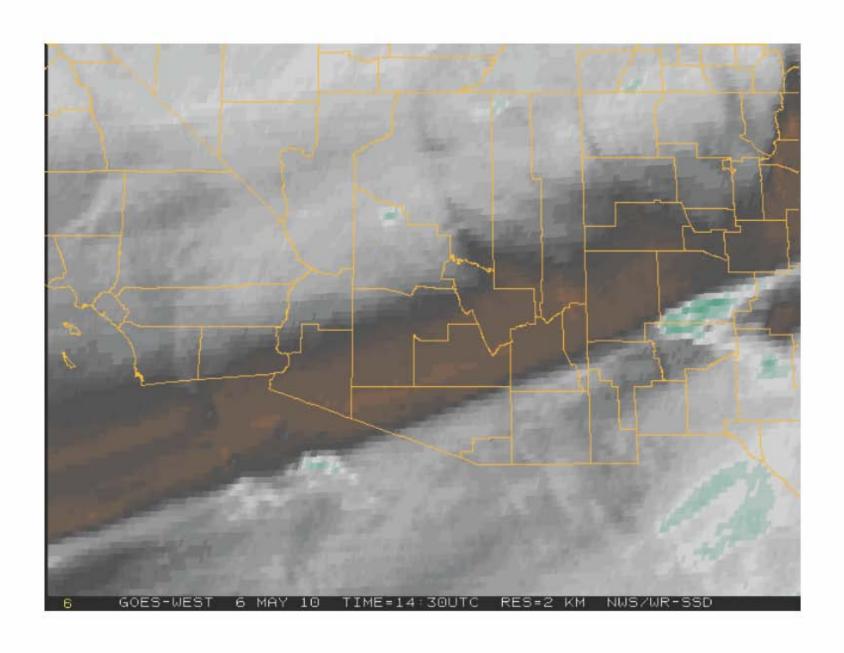
WV Satellite Data for Western US





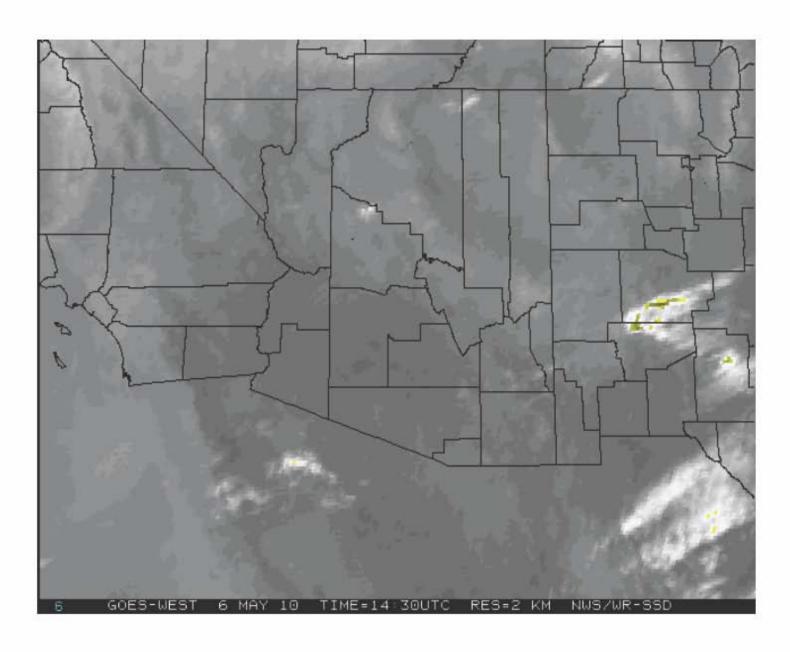
















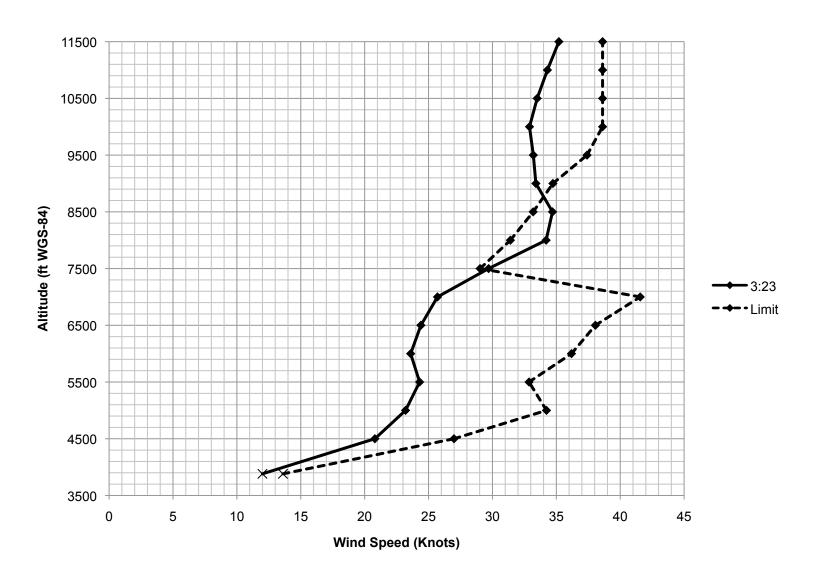


T-3:15 hrs Balloon (0945Z)

st																						
		Balloon Launch Local Time	3:23																			
		Measured W	inds	Comp	arison						Fligh	t Wind	l Limit	s								
		Balloon & LC-32E (Ball			rence loon - nit)	oon -			Azimuth Clockwise from 0° North (degrees) Meteorological Convention (Azimuth Defines Direction Wind is Blowing From)													
		Azimuth (Meterological degrees)	Wind Speed (knots)	(knots)	(percent)	Wind		1-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360			
	Ground Level ⁺	310	12	-1.6	-11.8%	_	Ground Level⁺	17.0	19.0	17.4	14.8	11.6	13.3	16.4	24.2	23.9	16.3	13.6	13.3			
Ellipsoid	4500	267	20.8	-6.2	-22.9%	WGS-84 Ellipsoid ft)	4500	16.2	18.9	18.1	14.8	14.9	16.0	21.4	29.8	27.0	18.1	18.2	17.2			
bS	5000	254		-11.0	-32.2%	ğ	5000	20.2	21.6	18.2	17.2	17.8	18.4	25.8	30.5	34.2	20.7	20.0	19.2			
∰	5500	254	24.3	-8.6	-26.1%	I∰	5500	21.4	22.7	18.2	16.6	16.5	21.9	25.4	30.8	32.9	23.9	20.1	20.6			
	6000	258			-34.8%	4	6000	20.8	23.8	20.5	17.9	18.4	18.5	26.5	33.3	36.2	28.3	21.4	23.3			
WGS-84 ft)	6500	265			-35.9%	φ	6500	23.1	25.7	21.3	18.0	18.4	18.7	27.8	36.2	38.1	28.8	24.5	24.5			
S	7000	267			-38.2%	S	7000	24.6	26.1	23.1	18.1	17.6	17.1	27.1	35.2	41.6	35.0	24.6	27.7			
≥ €	7500	262			2.3%	ž £	7500	17.9	17.1	14.3	15.7	14.2	15.8	19.1	26.3	29.0	23.0	18.8	18.2			
و پو	8000	257			8.9%	ے ہو	8000	19.7	17.5	14.8	17.6	17.2	16.8	20.2	28.1	31.4	25.0	19.5	19.8			
Above (8500	252			4.6%	Above (8500	21.3	17.2	14.7	17.2	17.1	17.0	20.6	29.9	33.2	27.6	21.0	21.1			
Ak	9000	246			-3.8%	¥	9000	22.6	17.9	15.7	16.5	16.4	16.3	20.3	31.7	34.7	28.7	22.0	23.2			
<u>0</u>	9500	243			-11.2%	e e	9500	23.8	18.4	16.2	15.7	16.4	17.6	21.3	33.6	37.4	30.7	24.0	24.0			
Altitude	10000	242			-14.8%	Altitude	10000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8			
臣	10500 11000	241			-13.3% -11.2%	连	10500 11000	23.2	18.1 18.1	17.4 17.4	17.2 17.2	17.6 17.6	18.1 18.1	21.7	33.4 33.4	38.6	32.7 32.7	25.9 25.9	26.8 26.8			
⋖	11500	242	 		-8.9%	⋖	11500	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6 38.6	32.7	25.9	26.8			
	11300	240	33.2	-3.4			11500	23.2	10.1	17.4	17.2	17.0	10.1	21.7	55.4	56.0	32.7	23.3	20.8			
		†C	22			+ 0 2004 5	C ft -b 14/00	04 Th:-!					Leader of the		-4410	22 /5 ft 46	21	11				
		†Ground Level refers to LC-3					ob π above wGS-	84. INIST	ne snouic	a be comp	ared to gr	ouna leve	ei wina me	easureme	nts at LC-:	32 (6 Tt AG	L), not ba	lloon data	1.			
			Violate L Meet Lin	•		ole							Keyfor Violate Meet L	Limits	ind Limits	Table						













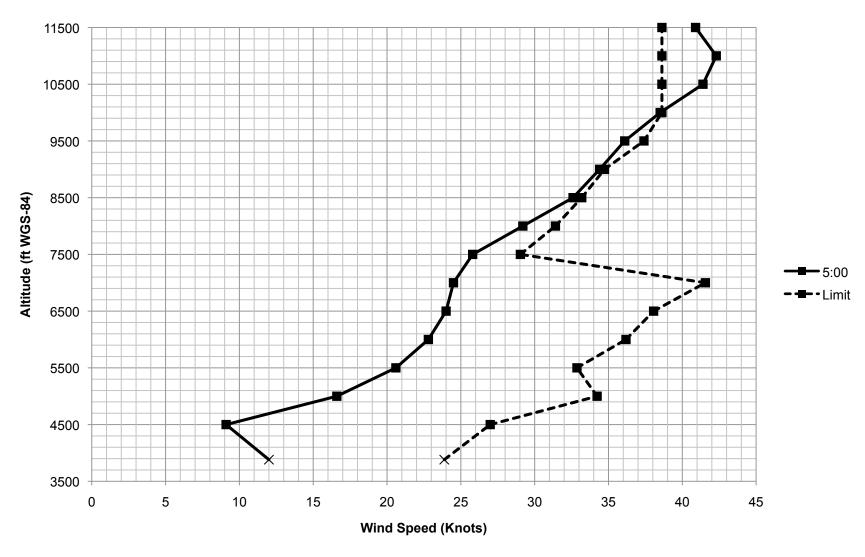
T-2:00 hrs Balloon (1100Z)

4																				
		Balloon Launch Local Time	5:00	·																
		Measured W	/inds	Comp	arison						Fligh	t Wind	l Limit	:s						
		Balloon & LC-32E Data Entry		(Bal	Difference (Balloon - Limit)		peeds in Knots	Azimuth Clockwise from 0° North (degrees) Meteorological Convention (Azimuth Defines Direction Wind is Blowing From)												
		Azimuth (Meterological degrees)	Wind Speed (knots)	(knots)	(knots) (percent) 🐠	Wind	na		31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360	
	Ground Level ⁺	270	12	-11.9	-49.7%		Ground Level ⁺	17.0	19.0	17.4	14.8	11.6	13.3	16.4	24.2	23.9	16.3	13.6	13.3	
ΪŽ	4500	254	9.1	-17.9	-66.3%	Ĕ	4500	16.2	18.9	18.1	14.8	14.9	16.0	21.4	29.8	27.0	18.1	18.2	17.2	
osc	5000	267	16.6	-17.6	-51.5%	SC	5000	20.2	21.6	18.2	17.2	17.8	18.4	25.8	30.5	34.2	20.7	20.0	19.2	
Ellipsoid	5500	259	20.6	-12.3	-37.3%	Ellipsoid	5500	21.4	22.7	18.2	16.6	16.5	21.9	25.4	30.8	32.9	23.9	20.1	20.6	
	6000	249	22.8	-13.4	-37.0%		6000	20.8	23.8	20.5	17.9	18.4	18.5	26.5	33.3	36.2	28.3	21.4	23.3	
≈	6500	253	24	-14.1	-36.9%	δþ	6500	23.1	25.7	21.3	18.0	18.4	18.7	27.8	36.2	38.1	28.8	24.5	24.5	
WGS-84 ft)	7000	261			-41.1%	WGS-84 ft)	7000	24.6	26.1	23.1	18.1	17.6	17.1	27.1	35.2	41.6	35.0	24.6	27.7	
ĕ£	7500	268			-11.1%		7500	17.9	17.1	14.3	15.7	14.2	15.8	19.1	26.3	29.0	23.0	18.8	18.2	
	8000	264			-7.0%	و بو	8000	19.7	17.5	14.8	17.6	17.2	16.8	20.2	28.1	31.4	25.0	19.5	19.8	
Above (8500	258			-1.8%	Above	8500	21.3	17.2	14.7	17.2	17.1	17.0	20.6	29.9	33.2	27.6	21.0	21.1	
¥	9000	254			-1.0%	¥	9000	22.6	17.9	15.7	16.5	16.4	16.3	20.3	31.7	34.7	28.7	22.0	23.2	
<u>0</u>	9500	252		-1.3	-3.5%	e e	9500	23.8	18.4	16.2	15.7	16.4	17.6	21.3	33.6	37.4	30.7	24.0	24.0	
Altitude	10000	255			-0.3%	Altitude	10000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8	
里	10500 11000	255 256			7.2% 9.5%	草	10500 11000	23.2	18.1 18.1	17.4 17.4	17.2 17.2	17.6 17.6	18.1 18.1	21.7	33.4 33.4	38.6 38.6	32.7 32.7	25.9 25.9	26.8 26.8	
٩	11500	256			5.9%	۹	11500	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8	
	11300	250	40.3	-103.2			11300	25.2	10.1	17.4	17.2	17.0	10.1	21.7	33.4	30.0	32.7	23.3	20.0	
		†Ground Level refers to LC	22 ground le			nt @ 2001	EE ft about MC	04 Th:-	line charr	ld bo see	nored to	round le	يما سنمط -	noosure:	onts at LC	22/6#	CI) not b	alloop de	to	
		Ground Level refers to LC					.56 It above wG	5-84. IIIIS	line snou	ia be com	ipared to	ground lev	/ei wind r	neasuren	ients at LC	-32 (0 IL A	GL), NOL D	alloon da	.a.	
			Violate Li Meet Lin	•	0 ,	ole							Keyfo Violate Meet L	Limits	ind Limits	Table				













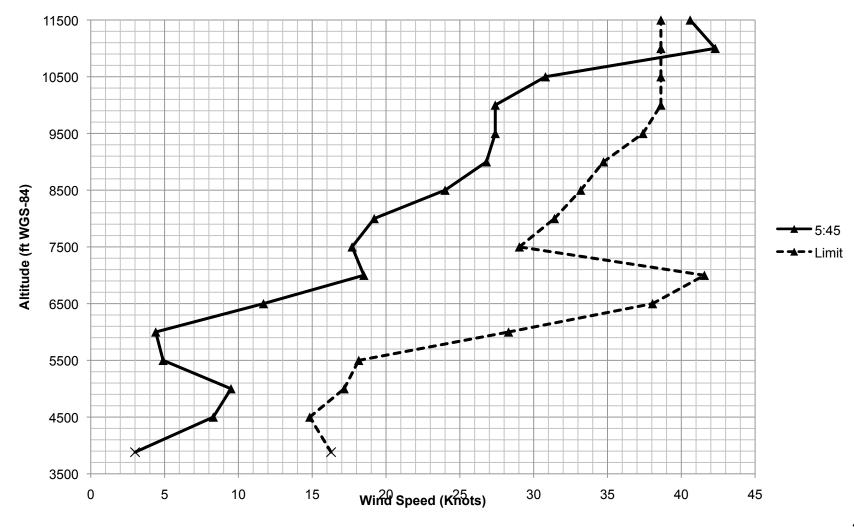


T-1:15 hrs Balloon (1145Z)

St Balloon Launch Local Time **Flight Wind Limits** Comparison Measured Winds Azimuth Clockwise from 0° North (degrees) wind Speeds in Knots Difference Balloon & LC-32E (Balloon -**Meteorological Convention** Data Entry Limit) (Azimuth Defines Direction Wind is Blowing From) Azimuth Wind Speed (knots) (percent) (Meterological degrees) (knots) 1-30 31-60 61-90 91-120 121-150 151-180 181-210 211-240 241-270 271-300 301-330 331-360 17.0 19.0 17.4 14.8 11.6 13.3 16.4 24.2 23.9 13.3 Ground Level* Ground Level Above WGS-84 Ellipsoid Altitude Above WGS-84 Ellipsoid 4500 -6.5 -44.0% 4500 16.2 18.9 18.1 14.9 16.0 21.4 29.8 27.0 119 8.3 14.8 18.1 17.2 5000 91 9.5 -7.7 -44.79 5000 20.2 21.6 18.2 17.8 18.4 25.8 30.5 34.2 20.7 20.0 19.2 5500 89 4.9 -13.3 -73.0% 5500 21.4 22.7 21.9 25.4 30.8 32.9 23.9 20.6 16.6 16.5 20.1 281 4.4 -23.9 -84.5% 20.8 23.8 20.5 18.5 33.3 36.2 6000 6000 17.9 18.4 26.5 28.3 23.3 6500 267 11.7 23.1 25.7 21.3 18.0 18.4 18.7 27.8 36.2 24.5 24.5 7000 265 18.5 7000 24.6 26.1 23.1 18.1 17.6 17.1 27.1 35.2 35.0 27.7 7500 255 17.7 -11.3 -39.09 7500 17.9 17.1 14.3 15.7 14.2 15.8 19.1 26.3 23.0 18.8 18.2 254 12.2 8000 19.2 8000 19.7 17.5 14.8 17.6 17.2 16.8 20.2 28.1 25.0 19.5 19.8 8500 252 24 -9.2 8500 21.3 17.2 14.7 17.2 17.1 17.0 20.6 29.9 27.6 21.1 252 26.8 22.6 16.3 28.7 9000 9000 17.9 15.7 16.5 20.3 31.7 23.2 255 -10.0 9500 27.4 23.8 18.4 17.6 9500 16.2 15.7 16.4 21.3 33.6 30.7 24.0 24.0 Altitude 10000 246 27.4 -29.19 10000 23.2 18.1 17.4 17.2 17.6 18.1 21.7 33.4 32.7 25.9 26.8 10500 252 30.8 10500 23.2 18.1 17.4 17.2 17.6 18.1 21.7 33.4 32.7 26.8 11000 254 42.3 11000 23.2 18.1 17.4 17.2 17.6 18.1 21.7 33.4 32.7 26.8 11500 252 40.6 11500 23.2 18.1 17.4 17.2 17.6 18.1 21.7 33.4 32.7 25.9 26.8 -178.1*Ground Level refers to LC-32 ground level wind measurement @ 3881.56 ft above WGS-84. This line should be compared to ground level wind measurements at LC-32 (6 ft AGL), not balloon data. **Key for Comparison Table** Key for Flight Wind Limits Table Violate Limits Violate Limits Meet Limits (<10% Margin) **Meet Limits** Meet Limits (>10% Margin)









8000

8500

9000

9500

10000

10500

11000

11500

St

Day of Launch Weather





T-0:45 hrs Balloon (1215Z)

Balloon Launch Local Time **Flight Wind Limits** Comparison Measured Winds Azimuth Clockwise from 0° North (degrees) Difference Balloon & LC-32E (Balloon -**Meteorological Convention** Data Entry Limit) (Azimuth Defines Direction Wind is Blowing From) Azimuth Wind Speed (knots) (percent) (Meterological degrees) (knots) 121-150 151-180 | 181-210 | 211-240 | 301-330 1-30 31-60 61-90 91-120 241-270 271-300 331-360 14.8 11.6 13.3 16.3 13.6 -13.4-77.0% 17.0 19.0 17.4 16.4 24.2 23.9 13.3 Ground Level* Ground Level* Altitude Above WGS-84 Ellipsoid **Ellipsoid** -9.2 -61.8% 16.2 18.9 14.8 16.0 21.4 29.8 18.1 18.2 17.2 4500 134 5.7 4500 18.1 14.9 5.6 -12.2 -68.5% 20.2 17.8 5000 127 21.6 18.2 17.2 18.4 25.8 30.5 34.2 20.7 20.0 19.2 113 4.2 -12.4 21.4 21.9 5500 5500 22.7 18.2 16.6 16.5 25.4 30.8 32.9 23.9 20.1 20.6 5.4 -12.5 -69.8% 17.9 101 18.4 18.5 21.4 23.3 6000 6000 20.8 23.8 20.5 26.5 33.3 36.2 28.3 WGS-84 6.9 -11.1 -61.7% 24.5 6500 104 6500 23.1 25.7 21.3 18.0 18.4 18.7 27.8 36.2 38.1 28.8 24.5 7000 78 6.4 -16.7 -72.3% 7000 24.6 26.1 23.1 18.1 17.6 17.1 27.1 35.2 41.6 35.0 24.6 27.7 3.8 -77.89 7500 58 -13.3 17.9 14.2 15.8 18.8 18.2

7500

8000

8500

9000

9500

10000

10500

11000

†Ground Level refers to LC-32 ground level wind measurement @ 3881.56 ft above WGS-84. This line should be compared to ground level wind measurements at LC-32 (6 ft AGL), not balloon data.

17.1

17.5

17.2

17.9

18.4

18.1

18.1

18.1

19.7

21.3

22.6

23.8

23.2

23.2

23.2

14.3

14.8

14.7

15.7

16.2

17.4

17.4

17.4

15.7

17.6

17.2

16.5

15.7

17.2

17.2

17.2

17.2

17.1

16.4

16.4

17.6

17.6

17.6

17.6

16.8

17.0

16.3

17.6

18.1

18.1

18.1

Key for Comparison Table Meet Limits (<10% Margin) Meet Limits (>10% Margin)

1.5

3.3

4.1

12

18.5

22.8

29.4

-26.6

-26.6

-27.6

-25.4

-20.1

-15.8

-9.2

-1.9

-254.1

-94.7%

-89.0%

-87.1%

-67.9%

-52.1%

-41.0%

Above

Altitude

229

231

235

258

259

261

264

Key for Flight Wind Limits Table Violate Limits Meet Limits

19.1

20.2

20.6

20.3

21.3

21.7

21.7

21.7

21.7

26.3

29.9

31.7

33.6

33.4

33.4

33.4

33.4

29.0

31.4

33.2

34.7

37.4

38.6

38.6

38.6

23.0

25.0

27.6

28.7

30.7

32.7

32.7

32.7

19.5

21.0

22.0

24.0

25.9

25.9

25.9

25.9

19.8

21.1

23.2

24.0

26.8

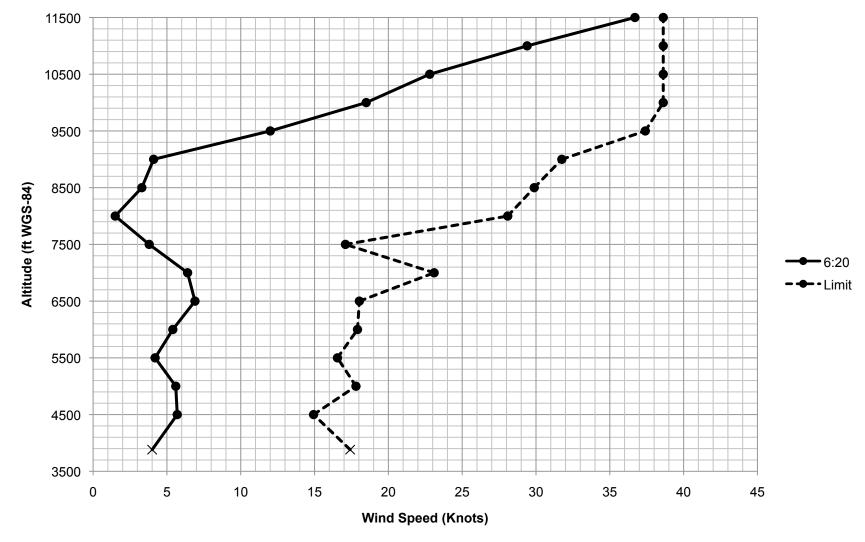
26.8

26.8













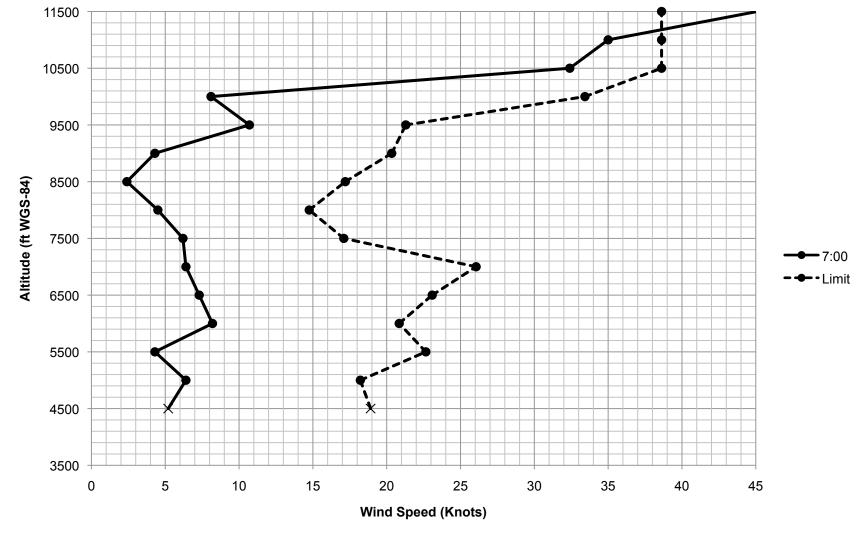


T-0:00 hrs Balloon (1300Z)

S																					
		Balloon Launch Local Time	7:00																		
		Measured W	/inds	Comp	arison						Fligh	t Wind	d Limit	s							
		Balloon & LC Data Entr	(Bal	Difference (Balloon - Limit)		Wind Speeds in Knots		Azimuth Clockwise from 0° North (degrees) <u>Meteorological Convention</u> (Azimuth Defines Direction Wind is <u>Blowing From</u>)													
		Azimuth (Meterological degrees)	Wind Speed (knots)	(knots)	(percent)	Mud	•	1-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300	301-330	331-360		
	Ground Level ⁺			FALSE	FALSE		Ground Level*	17.0	19.0	17.4	14.8	11.6	13.3	16.4	24.2	23.9	16.3	13.6	13.3		
Ellipsoid	4500	44	5.2	-13.7	-72.5%	Ellipsoid	4500	16.2	18.9	18.1	14.8	14.9	16.0	21.4	29.8	27.0	18.1	18.2	17.2		
Sc	5000	66	6.4	-11.8	-64.9%	Sc	5000	20.2	21.6	18.2	17.2	17.8	18.4	25.8	30.5	34.2	20.7	20.0	19.2		
I≣	5500	56	4.3	-18.4	-81.0%	I∰	5500	21.4	22.7	18.2	16.6	16.5	21.9	25.4	30.8	32.9	23.9	20.1	20.6		
ш	6000	24	8.2	-12.6	-60.7%		6000	20.8	23.8	20.5	17.9	18.4	18.5	26.5	33.3	36.2	28.3	21.4	23.3		
8	6500	22	7.3	-15.8	-68.4%	8	6500	23.1	25.7	21.3	18.0	18.4	18.7	27.8	36.2	38.1	28.8	24.5	24.5		
WGS-84	7000	39	6.4	-19.7	-75.4%	WGS-84 ft)	7000	24.6	26.1	23.1	18.1	17.6	17.1	27.1	35.2	41.6	35.0	24.6	27.7		
Ĭ Œ	7500	59	6.2	-10.9	-63.7%	ĕ £	7500	17.9	17.1	14.3	15.7	14.2	15.8	19.1	26.3	29.0	23.0	18.8	18.2		
ت ہو	8000	78	4.5	-10.3	-69.5%		8000	19.7	17.5	14.8	17.6	17.2	16.8	20.2	28.1	31.4	25.0	19.5	19.8		
Above (8500	105	2.4		-86.0%	Above (8500	21.3	17.2	14.7	17.2	17.1	17.0	20.6	29.9	33.2	27.6	21.0	21.1		
AP	9000	182			-78.9%	₽	9000	22.6	17.9	15.7	16.5	16.4	16.3	20.3	31.7	34.7	28.7	22.0	23.2		
	9500	198			-49.7%		9500	23.8	18.4	16.2	15.7	16.4	17.6	21.3	33.6	37.4	30.7	24.0	24.0		
Altitude	10000	225			-75.8%	Altitude	10000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8		
₽	10500	242			-16.1%	臣	10500	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8		
A	11000	249			-9.4%	₹	11000	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8		
	11500	253	45.1		16.8%		11500	23.2	18.1	17.4	17.2	17.6	18.1	21.7	33.4	38.6	32.7	25.9	26.8		
				-183.2																	
		[†] Ground Level refers to LC	-32 ground le	vel wind r	neasureme	ent @ 3881	.56 ft above WG	S-84. This	line shou	ld be com	pared to	ground le	vel wind r	neasurem	ents at LC	-32 (6 ft A	GL), not b	alloon dat	ta.		
			Violate Li Meet Lin	•	0 ,	ole							Keyfo Violate Meet l	Limits	ind Limits	Table					









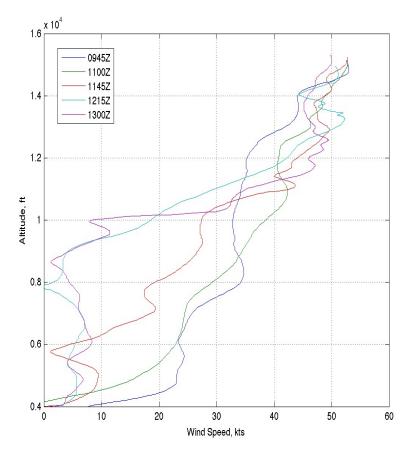


ANALYSIS



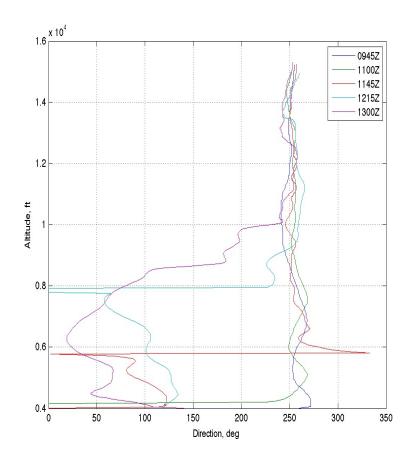
Weather Balloons Summary





- Speed decreases w/time
- Speed change occurs below 10Kft

Direction Agreement above 10kft

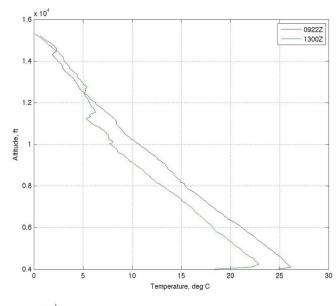


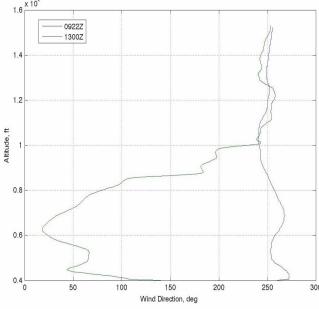


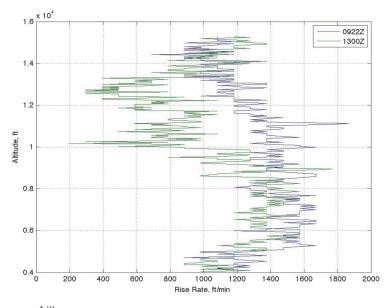
First and Last Balloon Comparison

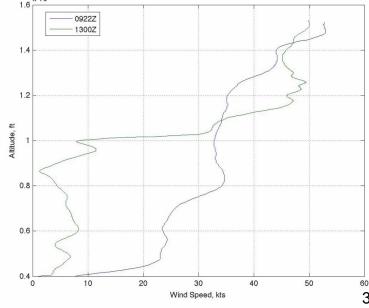










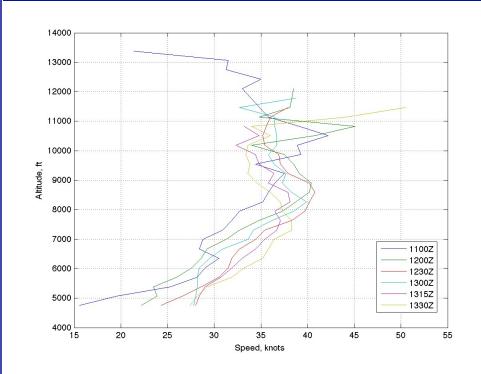




Balloon / Profiler Comparison

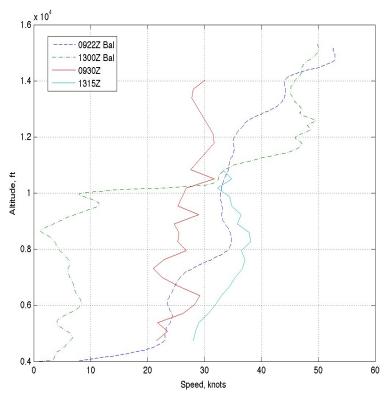






 First and last balloon w/Profiler comparison

- Two and a half hours of profiler soundings near launch
- Speeds are constant over time

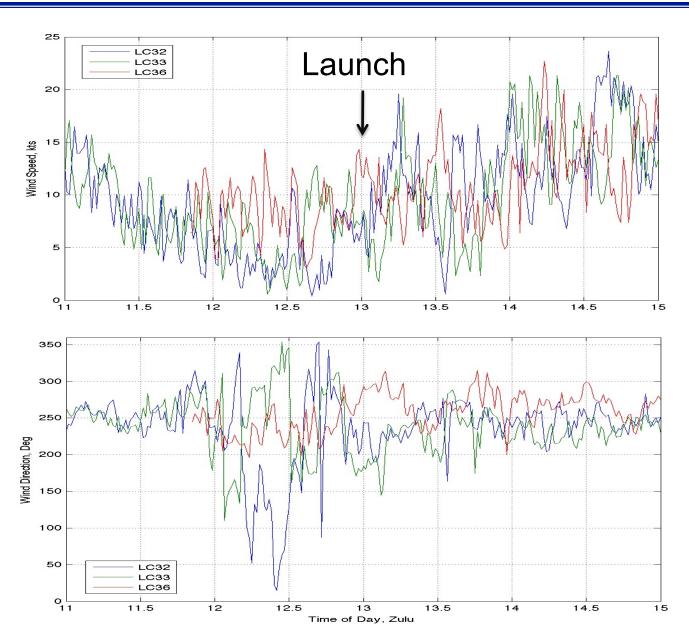




Surface Wind (6ft) Behavior at Launch





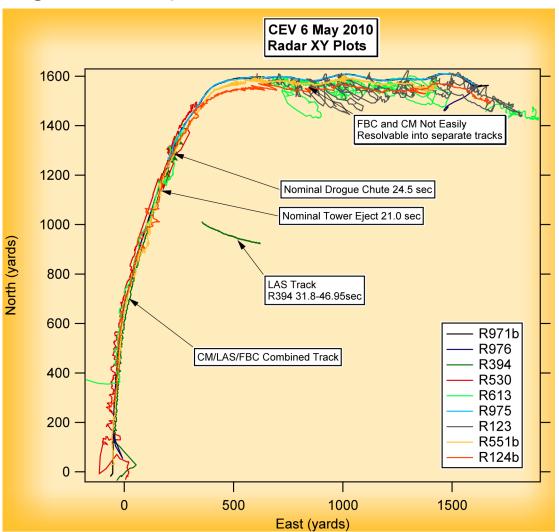




Radar Tracked Components



 Composite overlay of all of the valid radar tracks agree with profiler not balloon







- Upper level winds strong due to tightening gradients
- Terrain induced variability (block, deflect, waves...)
- Profiler should have been used in the go/no-go decision process
- Never enough sensors when terrain involve for re-analysis
- Mountain waves were in the vicinity and last balloon showed signs of being in a wave
- More time would be needed to really understand the events of the day---probably won't happen.